



Faculty of Engineering

Electrical and Computer Engineering Department | Communication Systems, ENEE3309

Course Project | 7/12/2024

**Project Outline: Using ADALM-Pluto for Monotone and Audio Signal Transmission/Reception
with the help of ChatGPT (Normal AM)**

This project provides students with hands-on experience using the ADALM-Pluto SDR and software like GNU Radio or MATLAB to implement communication systems. The aim is to design, tune, and analyze a system capable of transmitting and receiving monotone and audio signals. Students will document their work in IEEE paper format.

Project Workflow

1. Introduction and Background

- Overview of Software-Defined Radio (SDR) and ADALM-Pluto.
- Basics of AM modulation and demodulation.
- Signal characteristics: monotone signal vs. audio signal.

2. Objectives

- Design and simulate a communication system in GNU Radio or MATLAB.
 - Transmit and receive monotone and audio signals.
 - Fine-tune system parameters for optimal performance.
 - Document results and findings in IEEE format.
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3. System Requirements

- **Hardware:** ADALM-Pluto SDR
 - **Software:**
 - GNU Radio (preferred for flexibility).
 - MATLAB (optional, for additional exercises or comparison).
 - **Prerequisites:**
 - Familiarity with modulation techniques.
 - Basic knowledge of SDR concepts.
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4. Tasks

Task 1: Monotone Signal Transmission

1. Generate a monotone signal (e.g., 1 kHz sine wave).

2. Modulate the signal using the **Normal AM modulation**
3. Transmit using ADALM-Pluto.
4. Receive and demodulate the signal to recover the original tone.
5. Visualize the transmitted and received signals using QT GUI in GNU Radio or plots in MATLAB.

Task 2: Audio Signal Transmission

1. Capture an audio signal using a microphone or pre-recorded file.
2. Resample and modulate the audio signal.
3. Transmit the modulated signal using ADALM-Pluto.
4. Receive and demodulate to recover the audio signal.
5. Play the recovered audio using the computer's audio output.

Task 3: Parameter Tuning

1. Optimize transmit power and receiver gain for clear signal reception.
2. Fine-tune low-pass filter cutoff and transition width to minimize noise.
3. Document how changes in parameters affect system performance.

5. Documentation and Deliverables

Block Diagrams

- Include detailed diagrams of the transmitter and receiver flowgraphs.
- Explain the purpose of each block and its configurations.

Results

- Spectral analysis of transmitted and received signals.
- Screenshots of GNU Radio/MATLAB outputs.
- Audio quality evaluation (subjective and quantitative metrics).

IEEE Paper

Students must write a paper in IEEE format with the following sections:

1. **Abstract:** Summarize the project and findings.
 2. **Introduction:** Explain the problem, objectives, and tools used.
 3. **System Design:** Detail monotone and audio signals' flowgraph/block diagram.
 4. **Experiments and Results:** Present findings with visual aids.
 5. **Conclusion:** Discuss results and propose future improvements.
 6. **References:** Cite relevant resources (e.g., GNU Radio guides, SDR papers).
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Evaluation Criteria

- **Design (40%):** Correctness of flowgraphs/block diagrams.
- **Implementation (30%):** Successful signal transmission and reception.
- **Documentation (20%):** Clarity and completeness of the IEEE paper.
- **Tuning (10%):** Effectiveness of parameter optimization.